UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/045,951	01/11/2002	Yaron I. Gold	6284 USA/PDC/CD-SEM/OR	2709

32588 7590 08/12/2003

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER	
CASCHERA, ANTONIO A	
ART UNIT	**PAPER NUMBER**
2697	9

DATE MAILED: 08/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/045,951	GOLD, YARON I.	
	Examiner	Art Unit	
	Antonio A Caschera	2697	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,12-31 and 33-39* is/are rejected.

7)☒ Claim(s) *10,11 and 32* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Specification

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The abstract is not limited to a single paragraph.

2. The disclosure is objected to because of the following informalities:

b. The word, "a" should be changed to, "an" in the phrase, "...multiplication between a intensity value..." (see page 6, line 7).

c. The reference to an article titled, "The image processing handbook," must be corrected for completeness as no page numbers or sections are noted (see page 9, lines 20-25).

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-5, 17, 20-29 and 35-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (U.S. Patent 6,535,632 B1) in view of He et al. (U.S. Patent 6,600,517 B1).

In reference to claims 1, 26, and 37, Park et al. discloses image processing applied to an image frame to reduce and more uniformly distribute image noise (see lines 1-3 of abstract). Park et al. discloses receiving an input image frame, disclosed as an array of image pixels (see column 9, lines 48-54) which the office interprets as substantially similar to receiving a matrix of pixels. Park et al. also discloses generating a color gradient image comprising of matrix values representative of a difference between values of adjacent pixels (see column 9, lines 4-8, 27-37 and Figures 8a-c). Park et al. does not explicitly disclose calculating a center of mass for each pixel of the gradient image however He et al. does. He et al. discloses a system and method for sharpening edges of video images (see lines 1-2 of abstract). He et al. discloses a second circuit capable of determining a position of a first subpixel disposed between the first and second pixels wherein the first subpixel position is disposed approximately at a center of the edge (see column 2, lines 41-44). He et al. also discloses utilizing luminance and subpixel position values in the above second circuit (see column 2, lines 55-59). Note the office interprets the above pixel determination substantially similar to subsection (c) of applicant's claim 1. He et al. discloses modifying intensity values of second and third subpixels which are disposed on opposite sides of an edge (center of mass pixel) (see column 2, lines 45-49). He et al. also further discloses a second embodiment calling for the replacement of pixels close to the edge center with pixels farther away from the edge center (see column 5, lines 30-31). It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the image

processing methods of Park et al. with the system and methods of edge enhancement of He et al. in order to provide an improved system and method for enhancing edges of video images without introducing additional artifacts (see column 2, lines 24-30 of He et al.). Note, in reference to claims 26 and 37, He et al. discloses an edge estimation process receiving edge information identifying whether a selected pixel being processed is an edge (see column 8, lines 28-30). The office interprets such information as being substantially similar to center of mass information.

In reference to claims 2 and 28, Park et al. and He et al. disclose all of the claim limitations as applied to claims 1 and 27 respectively in addition, Park et al. discloses smoothing the image before generating a gradient image by applying smoothing filters to the input image (see column 7, lines 51-58, column 8, lines 51-52 and #24, 28, 30 of Figure 2).

In reference to claim 3, Park et al. and He et al. disclose all of the claim limitations as applied to claim 2 above in addition, Park et al. discloses smoothing the image to decrease noise resulting from intensity and saturation levels (see column 7, lines 33-58).

In reference to claim 4, Park et al. and He et al. disclose all of the claim limitations as applied to claim 2 above in addition, Park et al. discloses generating the color gradient image convolving a Gaussian operator with a pixel component (see column 9, lines 6-26). Note although Park et al. does not explicitly use the terminology, "Canny filter," the disclosure above of Park et al. is seen by the office as substantially similar to the description of a, "Canny filter" found on page 8 of applicant's specification.

In reference to claim 5, Park et al. and He et al. disclose all of the claim limitations as applied to claim 2 above in addition, Park et al. discloses applying a kernel operation on the pixels when smoothing the image (see columns 7-8, lines 51-62).

In reference to claim 17, Park et al. and He et al. disclose all of the claim limitations as applied to claim 1 above. He et al. discloses a second circuit capable of determining a position of a first subpixel disposed between the first and second pixels wherein the first subpixel position is disposed approximately at a center of the edge (see column 2, lines 41-44). The office interprets the first and second pixels to be positioned on opposite sides of the edge since the first subpixel is found at the center of the edge and between the first and second pixels thus the first and second pixels reflect the width of an edge.

In reference to claims 20, 21 and 35, Park et al. and He et al. disclose all of the claim limitations as applied to claims 1 and 26 above. He et al. discloses a second embodiment calling for the replacement of pixels close to the edge center with pixels farther away from the edge center (see column 5, lines 30-31).

In reference to claim 22, Park et al. and He et al. disclose all of the claim limitations as applied to claim 21 above in addition, He et al. discloses the selecting of a pixel responsive to the displacement of the center of mass and the pixel located in the vicinity of the center of mass (see column 5, lines 51-59 and Figure 2). The office interprets the line #215 of Figure 2 to represent the center of mass and pixels on both sides of #215 being moved toward #215 according to displacement from #215.

In reference to claim 23, Park et al. and He et al. disclose all of the claim limitations as applied to claim 22 above in addition, He et al. discloses calculating gain factors based on whether the pixels are adjacent to edges and/or their displacement from an edge (see column 8, lines 26-56). The office interprets the gain factors to be substantially similar to the weight factor of claim 23.

In reference to claim 24, Park et al. and He et al. disclose all of the claim limitations as applied to claim 23 above. Neither Park et al. nor He et al. explicitly disclose the weight factors responsive to the size of an object however it would have been obvious to one of ordinary skill in the art at the time the invention was made to create weight factors responsive to the size of an object in order to compensate for different displacements from pixels to the center of mass of objects as it is well known in the art that not all edges (objects) are of the same size.

In reference to claims 25, 36 and 38, Park et al. and He et al. disclose all of the claim limitations as applied to claims 1 and 26 respectively. Although Park et al. discloses a camera to capture a sensor image of an object or scene (see column 9, lines 54-60 and #530 of Figure 5), neither Park et al. nor He et al. explicitly disclose the use of a scanning electron microscope to generate the image. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to modify Park et al. by implementing a scanning electron microscope, instead of a camera, to generate the input image. Applicant has not disclosed that utilizing a scanning electron microscope provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with the camera of Park et al. because both devices supply image data in the form of pixel data. Therefore, it would have been obvious to one of ordinary skill in this art to modify Park et al. to obtain the invention as specified in claims 25, 36 and 38.

In reference to claim 27, Park et al. and He et al. disclose all of the claim limitations as applied to claim 26 above. Park et al. discloses generating a color gradient image comprising of matrix values representative of a difference between values of adjacent pixels (see column 9, lines 4-8, 27-37 and Figures 8a-c).

In reference to claim 29, Park et al. and He et al. disclose all of the claim limitations as applied to claim 27 above. He et al. discloses a second circuit capable of determining a position of a first subpixel disposed between the first and second pixels wherein the first subpixel position is disposed approximately at a center of the edge (see column 2, lines 41-44). He et al. also discloses utilizing luminance and subpixel position values in the above second circuit (see column 2, lines 55-59). Note the office interprets the above pixel determination substantially similar to calculating a center of mass for each pixel in response to gradient intensity values and neighboring pixels.

In reference to claim 39, Park et al. discloses image processing applied to an image frame to reduce and more uniformly distribute image noise (see lines 1-3 of abstract). Park et al. discloses receiving an input image frame, disclosed as an array of image pixels (see column 9, lines 48-54) which the office interprets as substantially similar to receiving a matrix of pixels. Park et al. does not explicitly disclose generating a matrix of values representative of the estimated edges in an image. He et al. discloses an edge estimation process receiving edge information identifying whether a selected pixel being processed is an edge (see column 8, lines 28-30). He et al. also discloses a second embodiment calling for the replacement of pixels close to the edge center with pixels farther away from the edge center (see column 5, lines 30-31). He et al. does not explicitly disclose generating a matrix of values representative of an edge or estimating an enhanced image represented by a matrix of pixels however, at the time the invention was made, it would have been obvious to one of ordinary skill in the art to generate the calculated pixel data of He et al. in matrix form. Applicant has not disclosed that generating matrices provides an advantage, is used for a particular purpose, or solves a stated problem. One

of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with the pixel data generation techniques of He et al. because He et al. has also performs estimating and enhancing edges using pixel data not specifically in matrix form. Therefore, it would have been obvious to one of ordinary skill in this art to modify He et al. to obtain the invention as specified in claim 39.

4. Claims 6-9, 13-16, 18, 19, 30, 31, 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (U.S. Patent 6,535,632 B1), He et al. (U.S. Patent 6,600,517 B1) and further in view of Acharya et al. (U.S. Patent 6,094,508).

In reference to claims 6 and 30, Park et al. and He et al. disclose all of the claim limitations as applied to claims 1 and 29 respectively above. Neither Park et al. nor He et al. explicitly disclose pixels neighboring a pixel of the gradient image to comprise within a neighborhood pattern however Acharya et al. does. Acharya et al. discloses a method for gradient-based edge detection (see title and lines 1-3 of abstract) whereby neighboring pixels of a gradient image are determined in a pattern by applying a mask (see column 7, lines 54-61 and Figures 4a-b). It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the image processing methods of Park et al. and the system/methods of edge enhancement of He et al. with the edge detection methods of Acharya et al. in order to better detect edge features allowing for the further removal of blurriness and enhancement of edges as edges that cannot be detected, cannot be enhanced (see column 1, lines 31-39 and 42-45 of Acharya et al.).

In reference to claims 7 and 31, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claims 6 and 30 respectively above in addition, Acharya et al.

discloses the neighborhood pattern being symmetric around a pixel (see Figures 4a-b, symmetric around pixel I4).

In reference to claim 8, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 6 above. Neither Park et al., He et al. nor Acharya et al. explicitly disclose the neighborhood pattern being asymmetric around a pixel however, at the time the invention was made, it would have been obvious to one of ordinary skill in the art to modify the neighborhood determining mask of Acharya et al. to apply an asymmetric pattern around a pixel. Applicant has not disclosed that an asymmetric pattern provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with a symmetric pattern because a symmetric pattern gives a good estimation of the relative strength of a center pixel against its neighbors (see column 7, lines 65-67 of Acharya et al.). Therefore, it would have been obvious to one of ordinary skill in this art to modify Acharya et al. to obtain the invention as specified in claim 8.

In reference to claim 9, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 6 above. Neither Park et al., He et al. nor Acharya et al. explicitly disclose the neighborhood pattern being selected from a list consisting of a cross, a diamond, a rectangle and an octagonal region however, at the time the invention was made, it would have been obvious to one of ordinary skill in the art to modify the neighborhood determining mask to apply one of the above patterns around a pixel. Applicant has not disclosed that one of the above patterns provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform

equally well with a symmetric pattern because a symmetric pattern gives a good estimation of the relative strength of a center pixel against its neighbors (see column 7, lines 65-67 of Acharya et al.). Therefore, it would have been obvious to one of ordinary skill in this art to modify Acharya et al. to obtain the invention as specified in claim 9.

In reference to claim 12, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 6 above. He et al. discloses a second circuit capable of determining a position of a first subpixel disposed between the first and second pixels wherein the first subpixel position is disposed approximately at a center of the edge (see column 2, lines 41-44). Since the neighborhood pattern is not clearly defined in the claims, the office interprets that the first subpixel of He et al., located at a center of an edge, could be disposed in a neighborhood pattern. Further, due to lack of clarity, the neighborhood pattern could be interpreted as the subpixel disposed a certain amount between first and second edge pixels.

In reference to claims 13 and 33, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claims 6 and 30 respectively in addition, Acharya et al. discloses changing the mask pattern to compensate for the two dimensions vertical and horizontal (see column 8, lines 37-45 and Figure 4b). Neither Park et al., He et al. nor Acharya et al. explicitly disclose performing the changing of the pattern followed by step (c) of claim 1 and prior to step (b) of claim 26 however it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the neighborhood pattern prior to calculating the center of mass of a pixel allowing for the new pattern to directly effect intensity values used in the calculations to compute center of mass and detect edges.

In reference to claim 14, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 13 above. Neither Park et al., He et al. nor Acharya et al. explicitly disclose changing the size of the neighborhood pattern however it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the size of the neighborhood pattern when processing images of higher resolution as higher resolution images may require the measuring of a greater number of surrounding pixels.

In reference to claims 15 and 34, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claims 1 and 29 above in addition, Acharya et al. discloses normalizing the gradient values of pixels in a neighboring region by dividing the already calculated gradient for a center pixel (computed by summing the results of a magnification between intensity value and location of the neighbor pixels) by the maximum gradient of all pixels within the local region (see column 8, lines 4-10, 50-56 and column 9, lines 20-51). Note the office interprets the above process as substantially similar to calculating the center of mass of a pixel.

In reference to claim 16, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 14 above in addition, He et al. discloses the selecting of a pixel responsive to the displacement of the center of mass and the pixel located in the vicinity of the center of mass (see column 5, lines 51-59 and Figure 2). The office interprets the line #215 of Figure 2 to represent the center of mass and pixels on both sides of #215 being moved toward #215 according to displacement from #215.

In reference to claim 18, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 16 above. Neither Park et al., He et al. nor Acharya et al.

explicitly disclose limiting modification of pixel values that are located in a vicinity of small objects however, it is well known in the image processing art for smaller objects to comprise of a lesser number of pixels when compared to larger objects (Official Notice). It would have been obvious to one of ordinary skill in the art for He et al., to limit the modifying of pixels located in the vicinity of smaller objects of images because it is well known in the art of image processing that smaller sized objects are made up of a smaller number of pixels thus making modifications to pixels in the objects more prone to visual artifacts, such as poor image smoothing and radical contrast changes, because they're a smaller number of pixels to begin with.

In reference to claim 19, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 16 above. Neither Park et al., He et al. nor Acharya et al. explicitly disclose preventing modification of pixel values that are located in a vicinity of small objects however, it is well known in the image processing art for smaller objects to comprise of a lesser number of pixels when compared to larger objects (Official Notice). It would have been obvious to one of ordinary skill in the art for He et al., to prevent the modifying of pixels located in the vicinity of smaller objects of images because it is well known in the art of image processing that smaller sized objects are made up of a smaller number of pixels thus making modifications to pixels in the objects more prone to visual artifacts, such as poor image smoothing and radical contrast changes, because they're a smaller number of pixels to begin with.

Allowable Subject Matter

5. Claims 10, 11 and 32 are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In reference to claim 10, the prior art of record (Park et al. (U.S. Patent 6,535,632 B1), He et al. (U.S. Patent 6,600,517 B1) and Acharya et al. (U.S. Patent 6,094,508)) does not disclose locating a pixel in a vicinity of a local center of mass if a distance between the pixel and at least a portion of the local center of mass does not exceed a, "length," of the neighborhood pattern in combination with further limitations of claim 1.

In reference to claim 11, the prior art of record (Park et al. (U.S. Patent 6,535,632 B1), He et al. (U.S. Patent 6,600,517 B1) and Acharya et al. (U.S. Patent 6,094,508)) does not disclose locating a pixel in a vicinity of a local center of mass if a distance between the pixel and at least a portion of the local center of mass does not exceed, "half a length," of the neighborhood pattern in combination with further limitations of claim 1.

In reference to claim 32, the prior art of record (Park et al. (U.S. Patent 6,535,632 B1), He et al. (U.S. Patent 6,600,517 B1) and Acharya et al. (U.S. Patent 6,094,508)) does not disclose locating a pixel in a vicinity of an edge if a distance between the pixel and at least a portion of the edge does not exceed a length of the neighborhood pattern in combination with further limitations of claim 1.

References Cited

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

a. Ott et al. (U.S. Patent 4,853,970)

- Ott et al. discloses a method and apparatus for processing a video image so as to feature the boundaries between light and dark regions of the image.

b. Braica (U.S. 2002/0097439 A1)

- Braica discloses a method and device for sharpening detected edges in an image by enhancing contrast between two sides of an edge region.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Antonio Caschera whose telephone number is (703) 305-1391. The examiner can normally be reached Monday-Thursday and alternate Fridays between 7:00 AM and 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Mancuso, can be reached at (703)-305-3885.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

aac

8/7/03

Matthew C. Bella

MATTHEW C. BELLA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600